

**APPARATUS FOR PROVIDING BURSTS OF SPRAY OF A FLUID**

Patent Number: WO9603218  
Publication date: 1996-02-08  
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Requested Patent: ☐ WO9603218  
Application Number: WO1995GB01759 19950725  
Priority Number (s): GB19940015227 19940728; GB19950006502 19950330  
IPC Classification: B05B9/04; B05B7/02; B05B11/00  
EC Classification: B05B7/00D, B05B11/00B5A2, B05B11/00P9H, B05B11/00Q4  
Equivalents: AU3084095  
Cited Documents: EP0401060; EP0511006; DE2623324; WO9116993; US4623337; EP0513350; EP0127573

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**Abstract**

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Apparatus for emitting bursts of scented liquid at intervals comprises a replaceable cartridge (27) which contains a reservoir of the liquid and which is fitted in a housing (1) of the apparatus. At intervals of time which are adjustable to the user, the apparatus produces bursts of spray from a nozzle (33) of the cartridge (27), the liquid droplets of the spray being carried upwardly away from the apparatus by a flow of air generated by a fan (25) in the housing (1).

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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>B05B 9/04, 7/02, 11/00</b>	<b>A1</b>	(11) International Publication Number: <b>WO 96/03218</b>
		(43) International Publication Date: 8 February 1996 (08.02.96)

(21) International Application Number: PCT/GB95/01759

(22) International Filing Date: 25 July 1995 (25.07.95)

(30) Priority Data:

9415227.9	28 July 1994 (28.07.94)	GB
9506502.5	30 March 1995 (30.03.95)	GB

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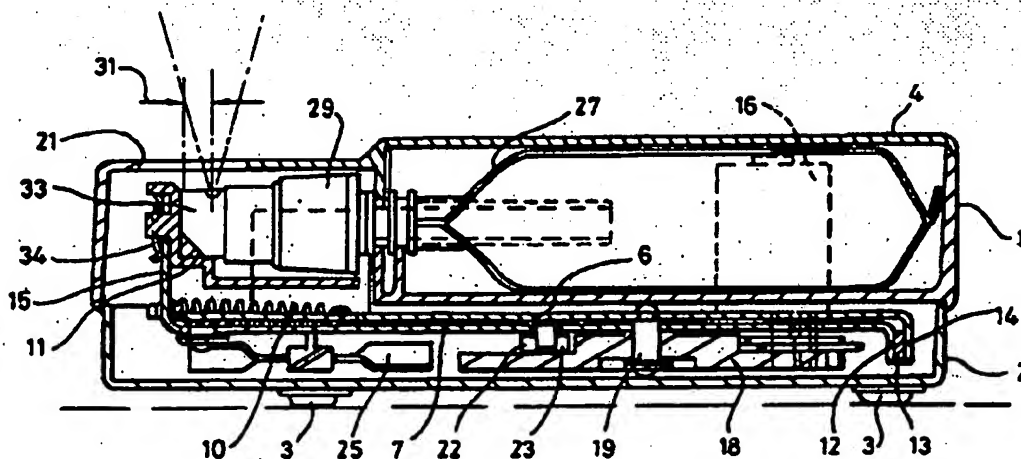
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(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).

Published

With international search report.

(54) Title: APPARATUS FOR PROVIDING BURSTS OF SPRAY OF A FLUID



## (57) Abstract

Apparatus for emitting bursts of scented liquid at intervals comprises a replaceable cartridge (27) which contains a reservoir of the liquid and which is fitted in a housing (1) of the apparatus. At intervals of time which are adjustable to the user, the apparatus produces bursts of spray from a nozzle (33) of the cartridge (27), the liquid droplets of the spray being carried upwardly away from the apparatus by a flow of air generated by a fan (25) in the housing (1).

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**TITLE: APPARATUS FOR PROVIDING BURSTS OF SPRAY OF A FLUID**

This invention relates to apparatus for providing bursts of spray of a fluid at intervals of time, and to a replaceable cartridge for insertion in such apparatus. The invention may be used for air freshening with fragrant or scented spray, air freshening with pure water spray, humidity control with water spray, insect control with insecticide spray or bacteria suppression with disinfectant spray.

According to one aspect of the invention there is provided apparatus for providing bursts of spray of a fluid at intervals of time, comprising a housing with a compartment to receive a replaceable cartridge holding the fluid, an abutment for engagement with the cartridge such that displacement of the abutment in one direction causes or allows fluid in an inserted cartridge to be drawn from a reservoir of the cartridge and into a delivery chamber of the cartridge ready for delivery, and displacement of the abutment in the other direction causes or allows fluid in the delivery chamber to be delivered as a burst of spray, the apparatus having electrically driven priming means operative to move the abutment in said one direction in order to charge the delivery chamber in the cartridge with fluid, the apparatus having delivery means operative to move the abutment in said other direction to cause the charge of fluid in the chamber to be ejected from a nozzle of the cartridge as a spray burst, and control means for effecting sequential operation of the priming means and the delivery means at timed intervals to produce said series of bursts of spray.

According to another aspect of the invention there is provided apparatus for producing a series of bursts of spray of fluid, comprising a housing accommodating a reservoir of fluid, a spray nozzle for delivery of the bursts of spray, a piston movable in a cylinder and cooperating with a non-return valve to draw fluid from the reservoir and into a chamber

in a suction stroke of the piston and in a pressure stroke to deliver the fluid in the chamber to the nozzle as a spray, priming means operative to move the piston in a suction stroke, delivery means operative to move the piston in a delivery stroke, a fan for generating an air flow which promotes dispersion of each spray burst and control means for effecting sequential operation of the priming means and delivery means at intervals to produce said series of bursts of spray.

According to a yet further aspect of the invention there is provided a cartridge for insertion in apparatus for producing a series of bursts of spray of a fluid, the cartridge comprising a reservoir of the fluid, a nozzle for delivering the spray bursts, a piston movable in a cylinder separated from the reservoir by a non-return valve, the piston being movable in a suction stroke to draw fluid from the reservoir, through the open valve and thence into a delivery chamber, and the piston being movable in a pressure stroke, during which the valve is closed, to pressurise the fluid in the chamber and eject it from the nozzle as a spray burst, spring means for biasing the piston in a direction corresponding to the pressure stroke, and the cartridge having orienting means to ensure the correct orientation of the nozzle with respect to the apparatus when the cartridge is placed in the apparatus.

Apparatus according to the invention, together with a replaceable cartridge for use in the apparatus, will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a plan view of the apparatus with a top cover removed to show internal detail,

Figure 2 is a sectional view on the line II-II of Figure 1,

Figure 3 illustrates part of the apparatus,

Figure 4 illustrates the replaceable cartridge,

Figure 5 illustrates the cartridge together with adjacent structure of the apparatus,

Figures 6 and 7 show alternative forms for a nozzle of the cartridge,

Figure 8 is a cross-sectional view of the nozzle assembly of the cartridge,

Figure 9 is a logic diagram explaining the operation of the apparatus, and

Figure 10 is a fragmentary view illustrating a possible modification of the nozzle.

Referring principally to Figures 1 and 2, the apparatus forms a portable air freshener unit for domestic use, being circular in plan view and typically having an external diameter of the order of 180mm. The apparatus has a plastics main housing 1 with an encircling cylindrical wall. The underside of the main housing is closed by a plastics base 2 which is fixed to the main housing 1 and which has four resilient feet 3. The top of the housing 1 is closeable by a removable plastics cover 4 which is capable of being snapped into position with respect to the main housing 1.

Removal of the cover 4 reveals two battery compartments for accommodating batteries 5 for powering the unit which requires no other source of power, although it is envisaged that a mains powered unit would be possible. The batteries 5 may be rechargeable (eg nickel/cadmium) or may be replaceable.

Within the housing 1 is fixed a metal baseplate 6, and Figure 3 is a view of the underside of the baseplate 6 and associated structure. A movable plate 7 is capable of limited sliding movement with respect to the baseplate 6 in a direction defined by the elongation of two slots 8, 9 in the movable plate 7. As a result, the plate 7 is capable of reciprocating movement in the housing 1 along a direction corresponding to the diametral line indicated at II-II in Figure 1. Two helical tension springs 10 bias the shiftable plate 7 in a direction causing an end flange 12 of the shiftable plate 7 to be urged towards a resilient pad 13 mounted on an end flange 14 of the baseplate 6. At the other end, the plate 7 has an upturned end flange 15 to which is attached a plastics cradle 11 forming an abutment for the nozzle of a cartridge inserted in the housing.

The batteries 5 provide electrical power to two electric motors. A first motor 16 drives, through a gear train 17 providing a step-down gear ratio, the outer periphery of a gear wheel 18 rotationally mounted in the baseplate 6 by means of a shaft or spindle 19 passing through the elongated slot 9. Concentric with the gear wheel 18 and rotatable therewith is a cam 20 having a profile illustrated in Figure 3. A cam follower 22 is rotationally mounted on the shiftable plate 7, the cam follower 22 being urged into engagement with the cam profile by the springs 10. This profile is such that, as the cam rotates in a clockwise direction from the position illustrated in Figure 3, the effective radius of the cam presented to the follower 22 increases until, at the point of maximum radius, there is an abrupt radial step 23 forming the transition between the maximum radius and minimum radius of the cam. Hence, as the gear wheel 18 rotates, the shiftable plate 7 is moved against the bias of the springs 10, ie towards the left as viewed in Figure 3. This progressive movement of the shiftable plate 7 proceeds until the cam follower 22 reaches the radial step 23 in the cam profile, at which point the springs 10 act to move the shiftable plate 7 abruptly towards the right as viewed in Figure 3, this sudden movement being cushioned by the pad 13. Thus, as the cam rotates the abutment 15 and cradle 11 undergo progressive movement towards the left as viewed in Figure 3 followed by a sudden and abrupt movement towards the right.

The second electric motor 24 drives a bladed fan 25 which draws air in through apertures in the base of the unit and directs the flow of air upwardly out of the housing through an area uncovered by the cover 4. In the described embodiment this uncovered area is a hole 21 (Figure 2) in the cover 4, the hole 21 being directly above the nozzle 33.

When the top cover 4 is removed the housing 1 presents a recess (Figure 5) to receive a removable cartridge 27 holding the scented liquid to be sprayed. The cartridge 27 positioned in the recess of the housing is illustrated in Figures 1, 2 and 5. The cartridge 27 has a flexible plastics bag-like enclosure 28 into which is sealed a plastics nozzle assembly 29, the shoulder of which has opposed slots 30 (Figure 4) to receive facing edges 32 of a wall 26 of the recess. A nozzle 33 forming the extremity of the nozzle assembly 29 locates in the cradle 11 attached to the abutment 15 by clip 34. When the cartridge 27 is fitted in the apparatus, the orifice 39 (Figure 4) of the nozzle 33 must point upwardly

as shown by the arrow 35 in Figures 5 to 7. If the nozzle 33 is capable of rotation with respect to the shoulder having the slots 30, the nozzle has a formation which cooperates with a formation in the apparatus so that the nozzle is correctly orientated. For example, the nozzle may have a slot 36 (Figure 7) shaped so as to cooperate with a projecting rib 37 on the cradle 11. Alternatively, the nozzle 33 may have a formation 38 which prevents relative rotation of the nozzle 33 with respect to the shoulder, as illustrated in Figure 6. In this case the location of the slots 30 in the shoulder with the facing edges 32 will ensure that the nozzle orifice is upwardly directed when the cartridge is placed in the apparatus.

The structure of the nozzle assembly 29 is shown in Figure 8. The nozzle orifice 39, communicates with the central bore 40 in a hollow piston 42 moveable in a cylinder 43 which communicates, through a one-way ball valve 44, with the interior of the plastics bag 28 forming the liquid reservoir. The piston 42 is urged by a helical compression spring 45 towards the left as viewed in Figure 8. The nozzle 33 is displaceable into the remainder of the nozzle assembly against the influence of the helical compression spring 45 which is therefore compressed at each spray burst, the amplitude of movement of the nozzle 33 being indicated at 31 in Figure 2.

When the abutment 15 and cradle 11 move to the left as viewed in Figure 3, the spring 45 urges the piston 42 (and the nozzle 33) towards the left in Figure 8, this constituting a priming stroke during which a metered dose of scented liquid is drawn from the enclosure 28, through the open valve 44 and thence into the cylinder 43. Upon the abutment 15 and cradle 11 moving sharply to the right as viewed in Figure 3 under the influence of the springs 10, the nozzle 33 and piston 42 are driven towards the right as viewed in Figure 8, this constituting a delivery stroke during which the metered dose of liquid in the cylinder 43 is pressurised (closing the valve 44) and is thus forced through the bore 40 and out of the nozzle 39 in a spray burst.

The electric motors 16 and 24 are energised under the control of electronic timing means at time intervals determined by the setting of a rotary knob 46 which forms a user control and which is visible in Figure 1. By setting the knob 46 to the appropriate position, the time interval between successive spray bursts can be adjusted from one hour to eight



hours, with the option of intermediate settings. Other time intervals are possible. The cartridge 27 is non-venting so the enclosure 28 collapses progressively as it is emptied of liquid. The enclosure 28 typically has a capacity of about 150ml but may be smaller. When the cartridge is spent the plastics cover 4 is removed to enable the used cartridge to be replaced with a new cartridge.

A logic diagram of the automatic operation of the apparatus is shown in Figure 9. The box 47 marked "Switch On" represents the movement of the rotary knob 46 from the off position to one of the positions 1 to 8, indicating a desired time interval between bursts of 1 to 8 hours. After the elapse of the chosen time interval (box 48), a proximity detector mounted in the apparatus checks (box 49) the presence or absence of a person near to the apparatus. If a person is detected in the proximity of the apparatus, the system is reset, line 50. If no person is detected in the proximity of the apparatus, a spray cycle (box 52) is initiated. This commences with energisation of the motor 24 which drives the fan 25 and with energisation of the motor 16 which rotates the cam 20, clockwise as viewed in Figure 3 from a rest position in which the follower 22 is approximately radially opposite the step 23. Rotation of the cam 20 causes the completion of priming of the cartridge and then, as the cam follower 22 encounters the radial step 23, the emission of a burst of liquid from the nozzle orifice. The liquid is in the form of fine droplets which are carried upwardly, through the area left uncovered by the cover 4 and away from the apparatus by the air flow generated by the fan 25.

After the burst, the cam 20 continues to rotate, to pre-prime the cartridge ready for the subsequent burst, until the cam follower is approximately rotationally opposite the step 23 when both motors are de-energised. This completes the spray cycle (line 53) and the apparatus remains quiescent in a stand-by mode, with the cartridge partially primed, until the timer initiates a subsequent spray cycle. A magnet carried by the gear wheel 18 conveniently cooperates with a fixed printed circuit board proximal to and overlapping the gear wheel 18, to provide a read-out of the rotational position of the gear wheel 18. Alternative positional indicators, such as a light emitting diode and light sensitive switch, may be used. The printed circuit board carries the logic or control means governing operation of the apparatus which is designed with minimum power requirements in mind.

Box 54 indicates that if the proximity detector (which performs the function of box 49) senses a person's proximity at any time during the spray cycle, the latter is aborted and the apparatus reset, (line 55).

Similarly, a daylight sensor 56 checks for the presence of daylight. If darkness has fallen, the apparatus resets (line 57), a feature which ensures that the apparatus functions only in the hours of daylight.

In the preferred embodiment, the proximity detector acts as a safety element to prevent the occurrence of a spray when someone is close to the apparatus, for example to prevent a burst of spray being ejected into a person's eye. The proximity detector could function in a reverse sense in certain applications and situations. For example, if the apparatus is for use in a bathroom or lavatory the proximity detector could function so as to cause the apparatus to emit a spray burst when a person enters the bathroom or lavatory. In this variation, a spray burst would be initiated by the proximity detector, and this operation could be additional to, or a replacement for, the timing means.

The daylight sensor 56 and proximity sensor are mounted in the apparatus in convenient positions. The daylight sensor must be mounted adjacent an opening or window in the casing to be responsive to ambient light. The proximity detector can be mounted close to the nozzle, with a defined cone angle of responsiveness, so that it prevents a spray burst occurring when a person is looking into the nozzle from close range.

The size of the fan 25 and its speed of rotation are set, in conjunction with the nozzle size and liquid pressure generated, to optimise droplet formation and dispersion, so that in use the liquid is effectively atomised and carried away from the apparatus by the forced air flow generated by the fan 25.

It has been found that the horizontal positioning of the nozzle with its recessed orifice pointing upwardly tends to cause a fine film of liquid to settle within the recessed orifice between spray bursts. This has an adverse effect on atomisation in the succeeding spray burst. To overcome this problem, the nozzle orifice may be formed in the centre of an

upwardly projecting dome or nipple 60, as illustrated in the fragmentary view of Figure 10. With this arrangement any liquid settling back onto the nozzle does not form a film over the nozzle orifice, so atomisation in a subsequent spray burst is not impaired. A further way of tackling this problem is to make the nozzle orifice point horizontally, which could be achieved by mounting the cartridge vertically, eg making the apparatus suitable for wall mounting in a generally vertical orientation.

The apparatus can be made to be part of a decorative and/or functional article, for example a clock, flower bowl or vase, radio/cassette or ornament.

**CLAIMS**

1. Apparatus for providing bursts of spray of a fluid at intervals of time, comprising a housing with a compartment to receive a replaceable cartridge holding the fluid, an abutment for engagement with the cartridge such that displacement of the abutment in one direction causes or allows fluid in an inserted cartridge to be drawn from a reservoir of the cartridge and into a delivery chamber of the cartridge ready for delivery, and displacement of the abutment in the other direction causes or allows fluid in the delivery chamber to be delivered as a burst of spray, the apparatus having electrically driven priming means operative to move the abutment in said one direction in order to charge the delivery chamber in the cartridge with fluid, the apparatus having delivery means operative to move the abutment in said other direction to cause the charge of fluid in the chamber to be ejected from a nozzle of the cartridge as a spray burst, and control means for effecting sequential operation of the priming means and the delivery means at intervals to produce said series of bursts of spray.
2. Apparatus according to claim 1 and including a fan for generating an air flow which promotes dispersion of the spray burst.
3. Apparatus according to claim 1 or 2, wherein the priming means comprises an electric motor rotatably driving a cam cooperating with a cam follower, the cam being shaped to cause the abutment initially to be moved in one direction and subsequently to allow movement of the abutment in the other direction under the influence of the delivery means.
4. Apparatus according to claim 3, wherein the delivery means comprises spring means which bias the abutment in said other direction.
5. Apparatus for producing a series of bursts of spray of a fluid, comprising a housing

accommodating a reservoir of fluid, a spray nozzle for delivery of the bursts of spray, a piston movable in a cylinder and cooperating with a non-return valve to draw fluid from the reservoir and into a chamber in a suction stroke of the piston and in a pressure stroke to deliver the fluid in the chamber to the nozzle as a spray, priming means operative to move the piston in a suction stroke, delivery means operative to move the piston in a delivery stroke, a fan for generating an air flow which promotes dispersion of each spray burst and control means for effecting sequential operation of the priming means and delivery means at intervals to produce said series of bursts of spray.

6. Apparatus according to claim 5, wherein the nozzle, piston, cylinder, non-return valve and reservoir form part of a cartridge which is capable of being inserted into the housing and removed from the housing and replaced by a fresh cartridge.

7. Apparatus according to any of the preceding claims wherein the control means are timing means operative to effect sequential operation of the priming means and delivery means at timed intervals.

8. Apparatus according to claim 7, wherein the timing means are adjustable to vary the intervals of time between successive spray bursts.

9. Apparatus according to any of the preceding claims and including a proximity detector for detecting the proximity of a person to the apparatus.

10. A cartridge for insertion in apparatus for producing a series of bursts of spray of a fluid, the cartridge comprising a reservoir of the fluid, a nozzle for delivering the spray bursts, a piston movable in a cylinder separated from the reservoir by a non-return valve, the piston being movable in a suction stroke to draw fluid from the reservoir, through the open valve and thence into a delivery chamber, and the piston being movable in a pressure stroke, during which the valve is closed, to pressurise the fluid in the chamber and eject it from the nozzle as a spray burst, spring means for biasing the piston in a direction corresponding to the pressure stroke, and the cartridge having orienting means to ensure the correct orientation of the nozzle with respect to the apparatus when the cartridge is

placed in the apparatus.

11. A cartridge according to claim 10, wherein the orientating means comprise a formation on the cartridge shaped to cooperate with a formation on the apparatus.
12. A cartridge according to claim 11, wherein the formation on the cartridge is a recess or slot for cooperation with a tab, rib or similar projecting formation on the apparatus.
13. A cartridge according to claim 11, wherein the formation on the cartridge is a projecting tab or rib for cooperation with a recess or slot in the apparatus.
14. A cartridge according to claim 10, wherein the cartridge has a nozzle assembly sealed to a flexible-walled enclosure forming the reservoir, the orienting means comprising parallel slots in the neck of the nozzle.
15. A cartridge according to any of claims 10 to 14, wherein the chamber is defined by the internal volume of the cylinder between the piston and the non-return valve.
16. A cartridge according to claim 15, wherein the piston has a central bore which communicates with an orifice of the nozzle, so that on a pressure stroke the fluid is forced from the chamber through the bore and ejected from the nozzle orifice.

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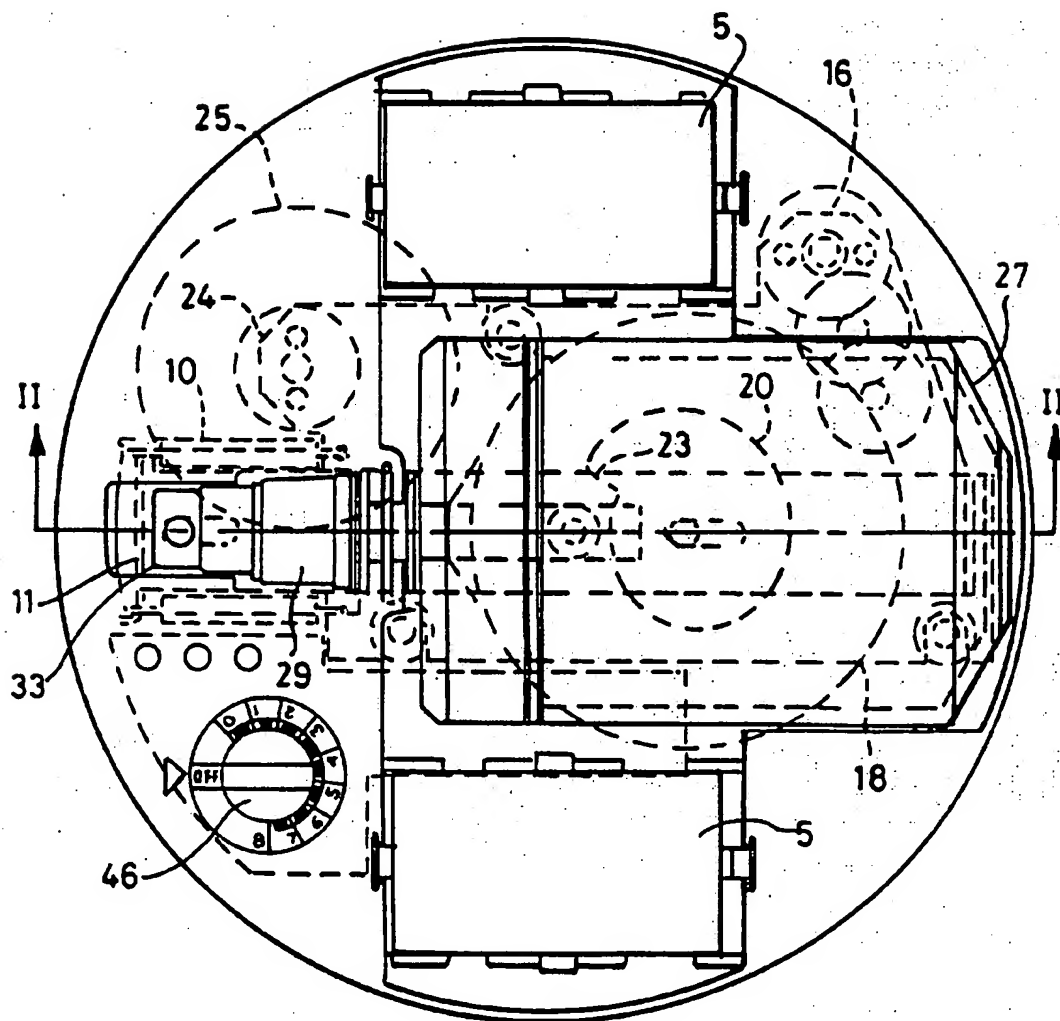


Fig. 1

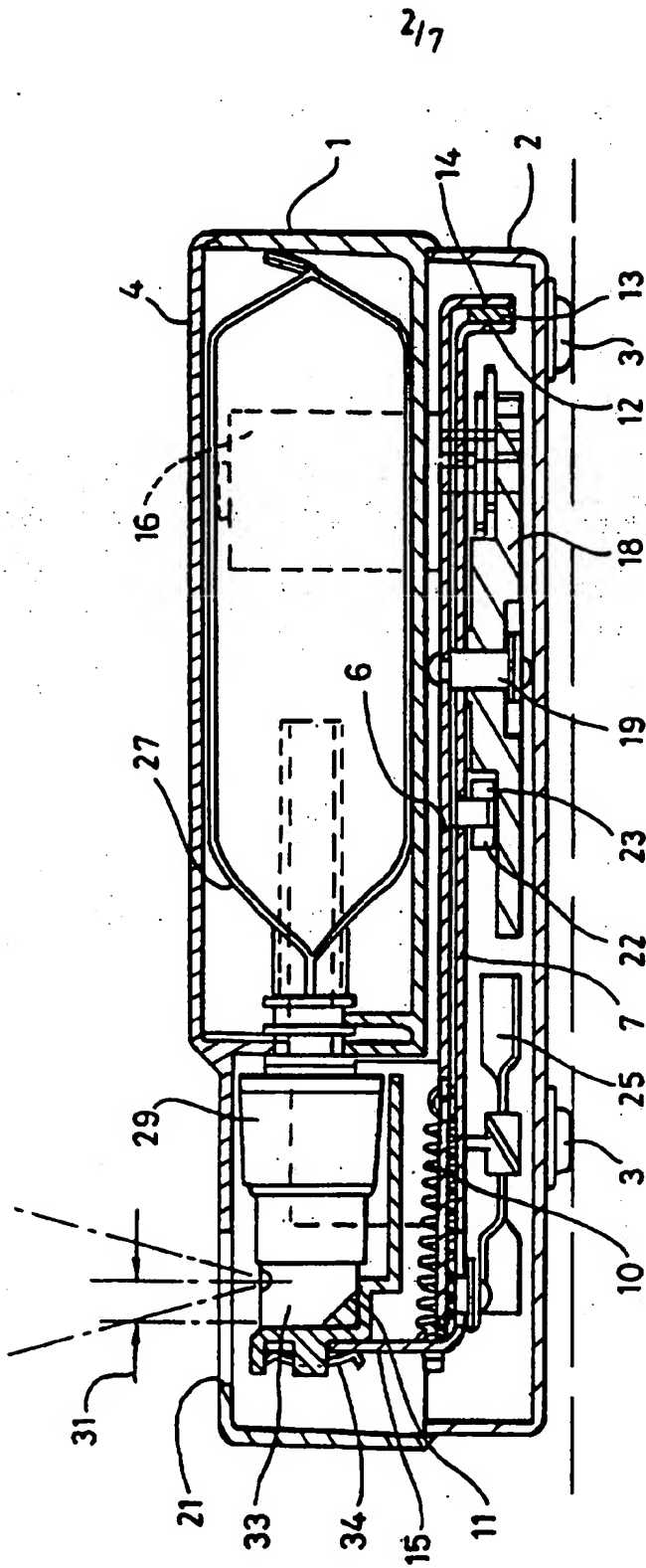


Fig. 2



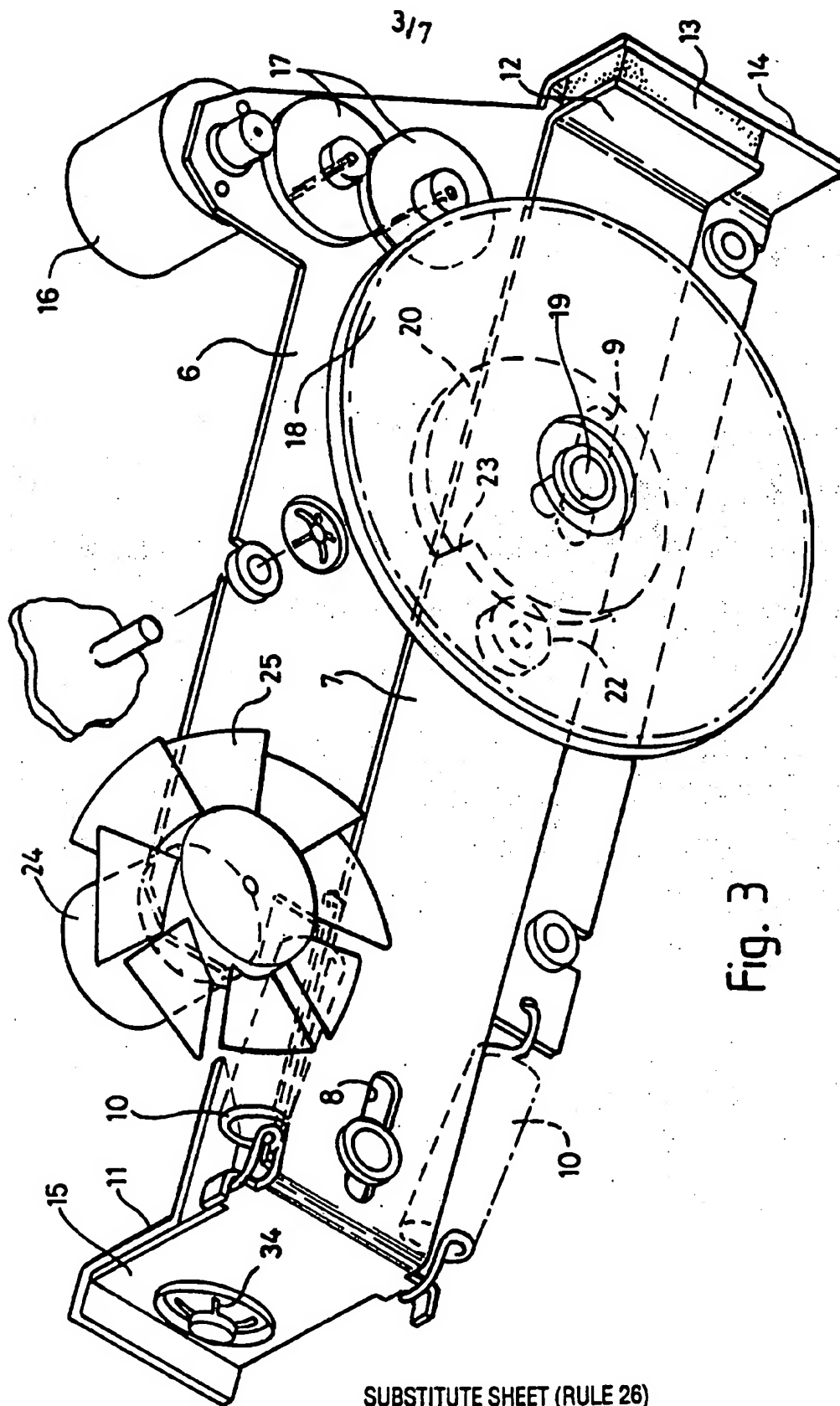


Fig. 3

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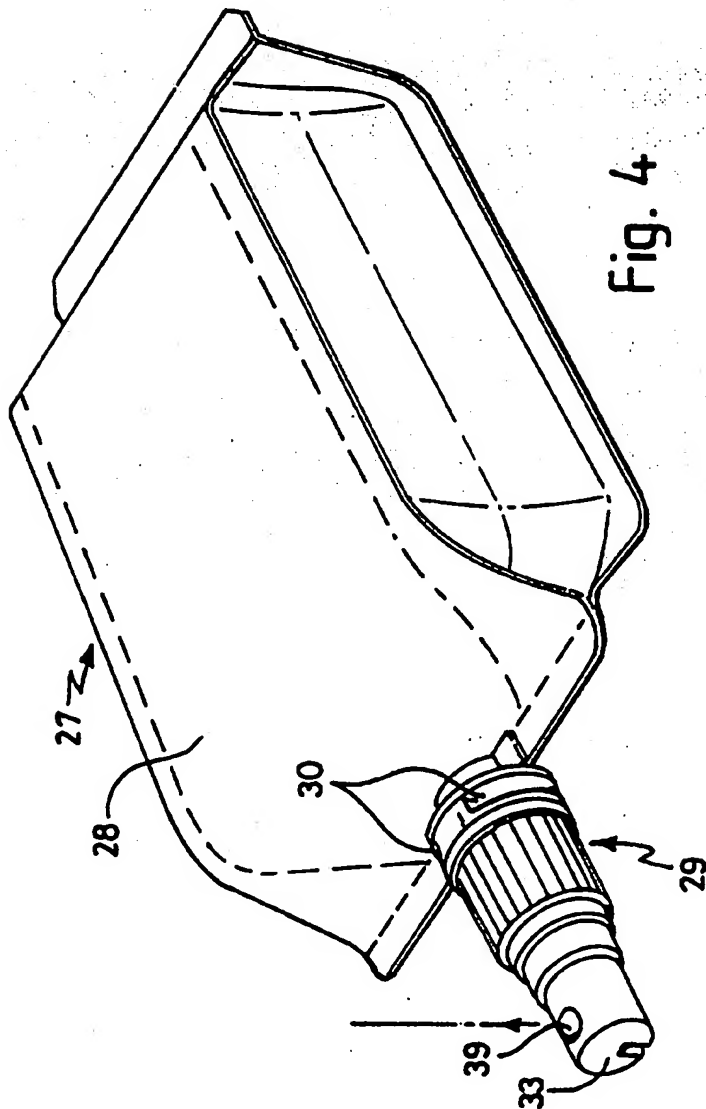


Fig. 4

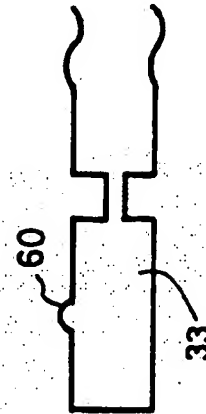
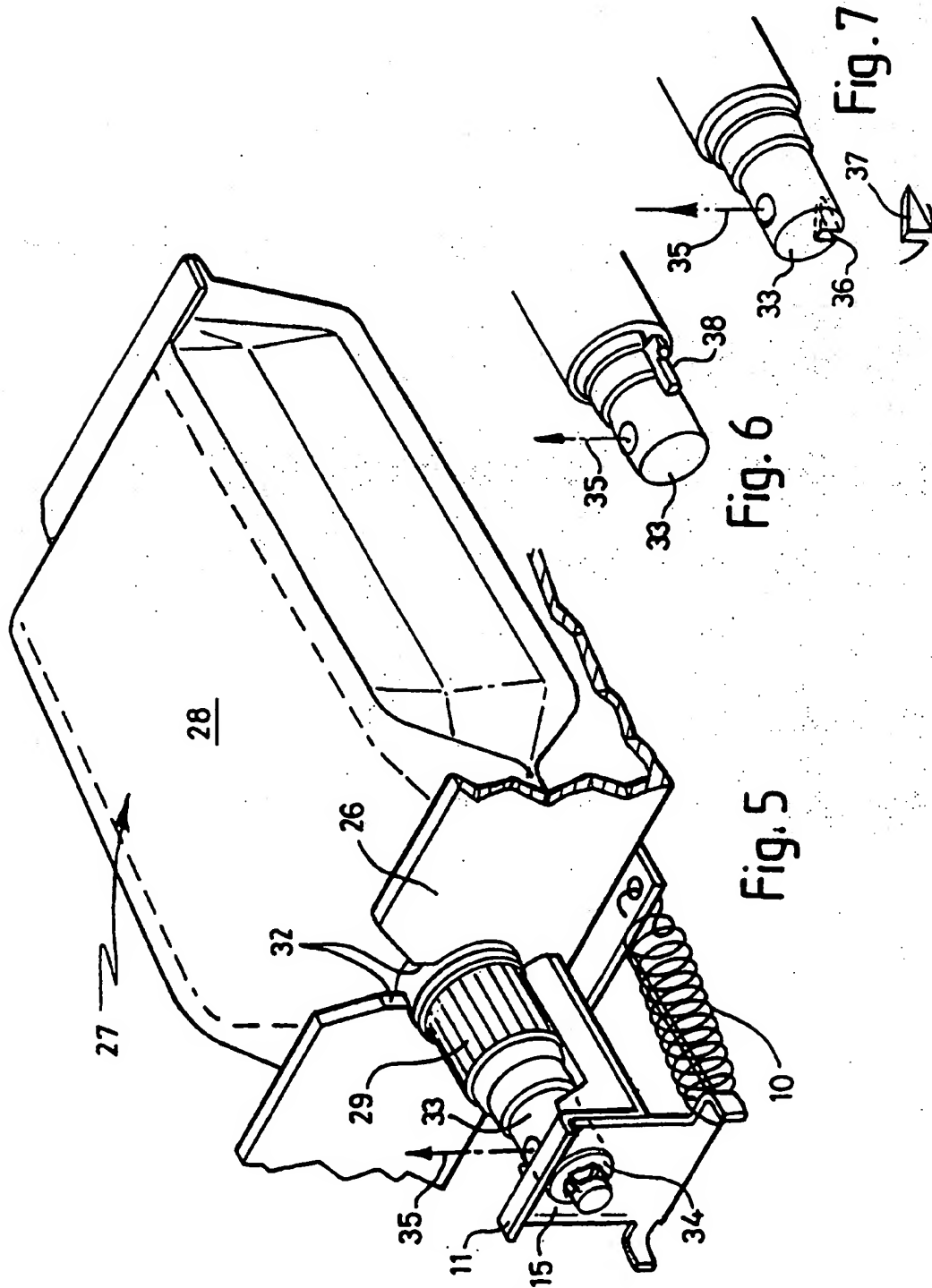


Fig. 10

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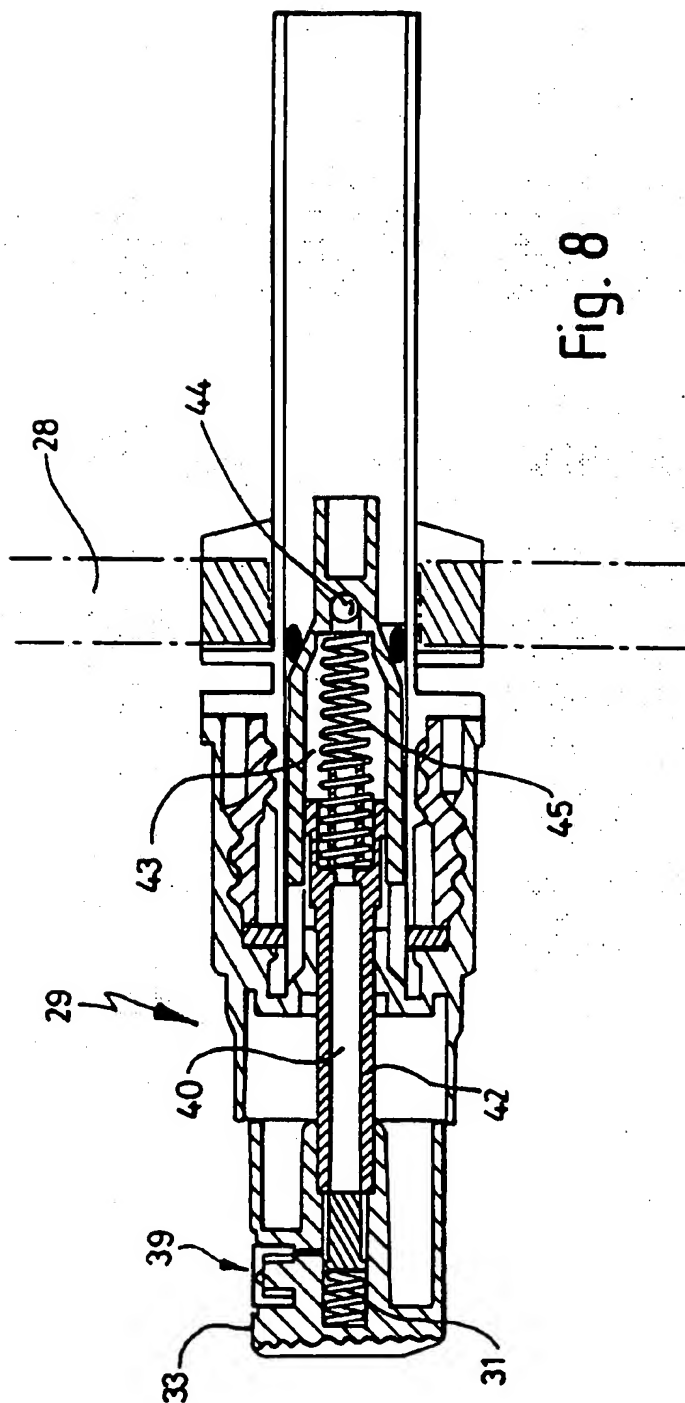


Fig. 8

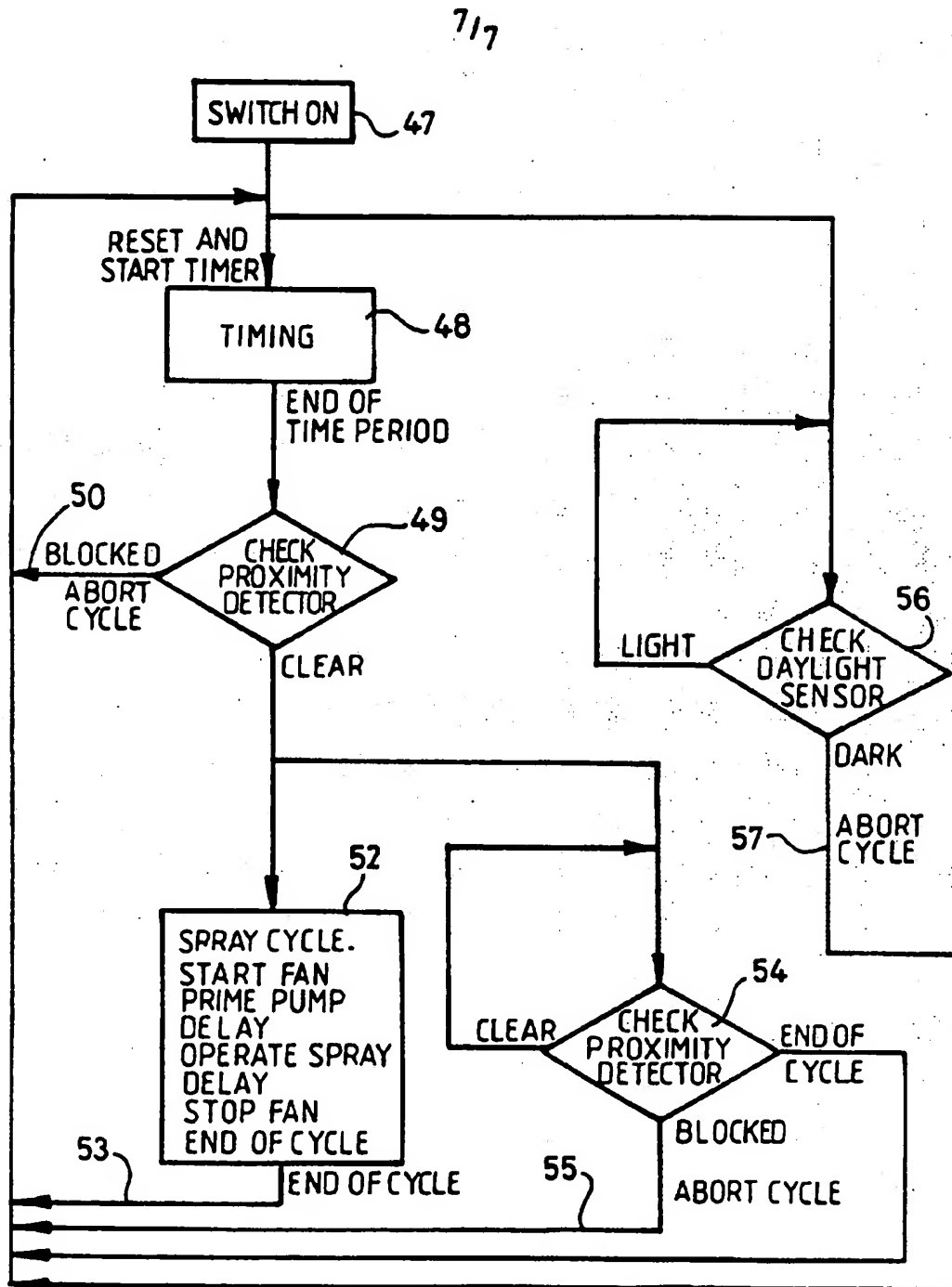


Fig. 9

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 95/01759

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B05B9/04 B05B7/02 B05B11/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 401 060 (CONCEPTAIR ANSTALT) 5 December 1990 see column 5, line 4 - line 15 see column 6, line 26 - column 7, line 6 see column 9, line 31 - line 43 see column 11, line 12 - line 18 see column 13, line 31 - column 14, line 48; figures ---	1,2,5-16
X	EP,A,0 511 006 (DAVID KENNEDY (ENGINEERS) HOLDINGS LIMITED) 28 October 1992 ---	1,3, 10-13, 15,16 5-8
A	see column 3, line 4 - column 4, line 9; figures ---	
A	DE,A,26 23 324 (WELLA AG) 15 December 1977 see claims; figures ---	3
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Intern. Appl. No.  
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US,A,4 623 337 (MAURICE) 18 November 1986 see column 4, line 63 - column 5, line 17; figure 9 ---	3,4
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 Inter. Application No  
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